

WHAT IS CLAIMED IS

1. An artificial proprotein, comprising three peptide sequences:
 - (a) a first peptide sequence of interest;
 - (b) a propeptide sequence attached to the C-terminus of the first peptide sequence of interest; and
 - (c) a second peptide of interest attached to the C-terminus of the propeptide sequence.
2. The artificial proprotein of claim 1, further comprising a signal peptide sequence attached to the N-terminus of the first peptide sequence of interest.
3. The artificial proprotein of claim 1 that comprises an antibody light chain peptide and an antibody heavy chain peptide, wherein the first peptide is either a heavy chain of the antibody or a light chain of the antibody, and wherein the second peptide is either a heavy chain of the antibody or a light chain of the antibody.
4. The artificial proprotein of claim 1 that comprises an antibody light chain peptide and a Fd heavy chain peptide, wherein the first peptide is either a heavy chain or an antibody light chain, and wherein the second peptide is either a Fd or an antibody light chain.
5. The artificial proprotein of claim 1 that comprises a light chain peptide and a heavy chain peptide of a Fab fragment derivative or an antibody derivative, wherein the first peptide is either a heavy chain of the Fab fragment or antibody derivative or a light chain of the Fab fragment or antibody derivative, and wherein the second peptide is either a heavy chain of the Fab fragment or antibody derivative or a light chain of the Fab fragment or antibody derivative.
6. An artificial polynucleotide, comprising four nucleotide sequences:
 - (a) a first nucleotide sequence that encodes a signal peptide sequence;
 - (b) a second nucleotide sequence that encodes a first peptide of interest, second nucleotide sequence being connected to the 3' terminus of the first nucleotide sequence;
 - (c) a third nucleotide sequence that encodes a propeptide, third nucleotide sequence being connected to the 3' terminus of the second nucleotide sequence; and

(d) a fourth nucleotide sequence that encodes a second peptide of interest, fourth nucleotide sequence being connected to the 3' terminus of the third nucleotide sequence.

7. The artificial polynucleotide of claim 6 that encodes a polypeptide that comprises an antibody light chain peptide and an antibody heavy chain peptide, wherein the first peptide is either a heavy chain of the antibody or a light chain of the antibody, and wherein the second peptide is either a heavy chain of the antibody or a light chain of the antibody.

8. The artificial polynucleotide of claim 6 that encodes a polypeptide that comprises a Fab fragment light chain peptide and a Fab fragment heavy chain peptide, wherein the first peptide is either a heavy chain of the Fab fragment or a light chain of the Fab fragment, and wherein the second peptide is either a heavy chain of the Fab fragment or a light chain of the Fab fragment.

9. The artificial polynucleotide of claim 6 that encodes a polypeptide that comprises a light chain peptide and a heavy chain peptide of a Fab fragment derivative or an antibody derivative, wherein the first peptide is either a heavy chain of the Fab fragment derivative or antibody derivative or a light chain of the Fab fragment or antibody derivative.

10. A method of making the artificial polynucleotide of claim 6, comprising:

(a) providing a first, a second, a third and a fourth nucleotide sequence that encode a signal peptide sequence, a first peptide of interest, a propeptide and a second peptide of interest, respectively,

(b) connecting the 3' terminus of the first nucleotide sequence to the 5' terminus of the second nucleotide sequence;

(c) connecting the 3' terminus of the second nucleotide sequence to the 5' terminus of the third nucleotide sequence; and

(d) connecting the 3' terminus of the third nucleotide sequence to the 5' terminus of the fourth nucleotide sequence, wherein the nucleotide sequence that encodes a first peptide of interest can be the same as or different from the nucleotide sequence that encodes a second peptide of interest.

11. The method of claim 10 wherein the artificial polynucleotide encodes a polypeptide that comprises an antibody light chain peptide and an antibody heavy chain peptide, wherein

the second nucleotide sequence encodes either a heavy chain of the antibody or a light chain of the antibody, and wherein the fourth nucleotide sequence encodes either a heavy chain of the antibody or a light chain of the antibody.

12. The method of claim 10 wherein the artificial polynucleotide encodes a polypeptide that comprises a Fab light chain peptide and a Fab heavy chain peptide, wherein the second nucleotide sequence encodes either a heavy chain of the Fab fragment or a light chain of the Fab fragment, and wherein the fourth nucleotide sequence encodes either a heavy chain of the Fab fragment or a light chain of the Fab fragment.

13. The method of claim 10 wherein the artificial polynucleotide encodes a polypeptide that comprises a light chain peptide and a heavy chain peptide of a Fab fragment derivative or an antibody derivative, wherein the second nucleotide sequence encodes either a heavy chain of the Fab fragment or antibody derivative or a light chain of the Fab fragment or antibody derivative, and wherein the fourth nucleotide sequence encodes either a heavy chain of the Fab fragment or antibody derivative or a light chain of the Fab fragment or antibody derivative.

14. A method of making an artificial preproprotein, comprising:

- (a) making an artificial polynucleotide that encodes the preproprotein; and
- (b) expressing the artificial polynucleotide in a host organism whereby the preproprotein is made.

15. A method of making a multimeric protein, comprising:

- (a) providing a first, a second, a third and a fourth nucleotide sequence that encode a signal peptide sequence, a first peptide of interest, a propeptide and a second peptide of interest, respectively;
- (b) connecting the 3' terminus of the first nucleotide sequence to the 5' terminus of the second nucleotide sequence;
- (c) connecting the 3' terminus of the second nucleotide sequence to the 5' terminus of the third nucleotide sequence; and

(d) connecting the 3' terminus of the third nucleotide sequence to the 5' terminus of the fourth nucleotide sequence, so that an artificial polynucleotide results and is comprised of the four nucleotide sequences, and wherein the nucleotide sequence that encodes a first peptide of interest can be the same as or different from the nucleotide sequence that encodes a second peptide of interest;

(i) introducing the resulting artificial polynucleotide into a host organism by transfection, or by stable transformation;

(ii) allowing the artificial polynucleotide to be expressed in the host organism whereby a preproprotein is made;

(iii) allowing the preproprotein to be processed into a mature polypeptide.

16. The method of claim 15 further comprising allowing two copies of the mature polypeptide to bond to form a mature multimeric protein.

17. The method of claim 15 wherein the multimeric protein is an antibody or a Fab fragment or a derivative of either the antibody or the Fab fragment.

18. A vector encoding an artificial preproprotein, comprising:

(a) a nucleotide sequence necessary for replication of the vector nucleotides and proteins; and

(b) the artificial polynucleotide of claim 6 inserted into the vector.

19. A method for making a transgenic plant capable of producing immunoglobulin molecules, comprising:

(a) introducing into the genome of a member of a plant species an artificial polynucleotide sequence encoding a preproprotein wherein the preproprotein comprises a) a signal peptide sequence, b) an immunoglobulin heavy chain or light chain peptide, c) a propeptide, and d) an immunoglobulin heavy chain or light chain peptide, wherein the heavy chain can be in either the b or the d position on the preproprotein, and the light chain will be on the other position; and

(b) allowing stable transformation to occur to produce a transformant.

20. A vector comprising a single DNA sequence encoding at least a variable domain of an immunoglobulin heavy chain and at least a variable domain of an immunoglobulin light chain wherein said single DNA sequence is located in said vector at a single insertion site.
21. A method comprising:
- (a) preparing a DNA sequence consisting essentially of DNA encoding an immunoglobulin consisting of an immunoglobulin heavy chain and light chain or Fab region, said immunoglobulin having specificity for a particular known antigen, wherein the DNA sequence incorporates an artificial polynucleotide encoding a proprotein which consists of at least a variable domain of an immunoglobulin heavy chain, a cleavable propeptide, and at least the variable domain of an immunoglobulin light chain;
 - (b) inserting the DNA sequence of step a) into a replicable expression vector operably linked to a suitable promoter;
 - (c) transforming a prokaryotic or eukaryotic microbial host cell culture with the vector of step b);
 - (d) culturing the host cell; and
 - (e) recovering the immunoglobulin from the host cell culture, said immunoglobulin being capable of binding to a known antigen.
22. A process for producing an immunoglobulin molecule or an immunologically functional immunoglobulin fragment comprising at least the variable domains of the immunoglobulin heavy and light chains, in a single host cell, comprising:
expressing a single DNA sequence encoding at least the variable domain of the immunoglobulin heavy chain and at least the variable domain of the immunoglobulin light chain so that said immunoglobulin heavy and light chains are produced as a single proprotein molecule in said single host cell transformed with said single DNA sequence.
23. A multimeric protein, comprising first and second peptides, the first peptide comprising a non-native amino acid pair at the P1 and P2 positions of the carboxy terminus.
24. A multimeric protein according to claim 23 wherein the P2 position is occupied by Lys, Pro, or Arg.
25. A multimeric protein according to claim 23 wherein the P1 position is occupied by Lys, Pro, or Arg.

26. A multimeric protein derived from the multimeric protein of claim 23, comprising a first and second peptides, the first peptide comprising a non-native amino acid pair at the P1 and P2 positions of the carboxy terminus.